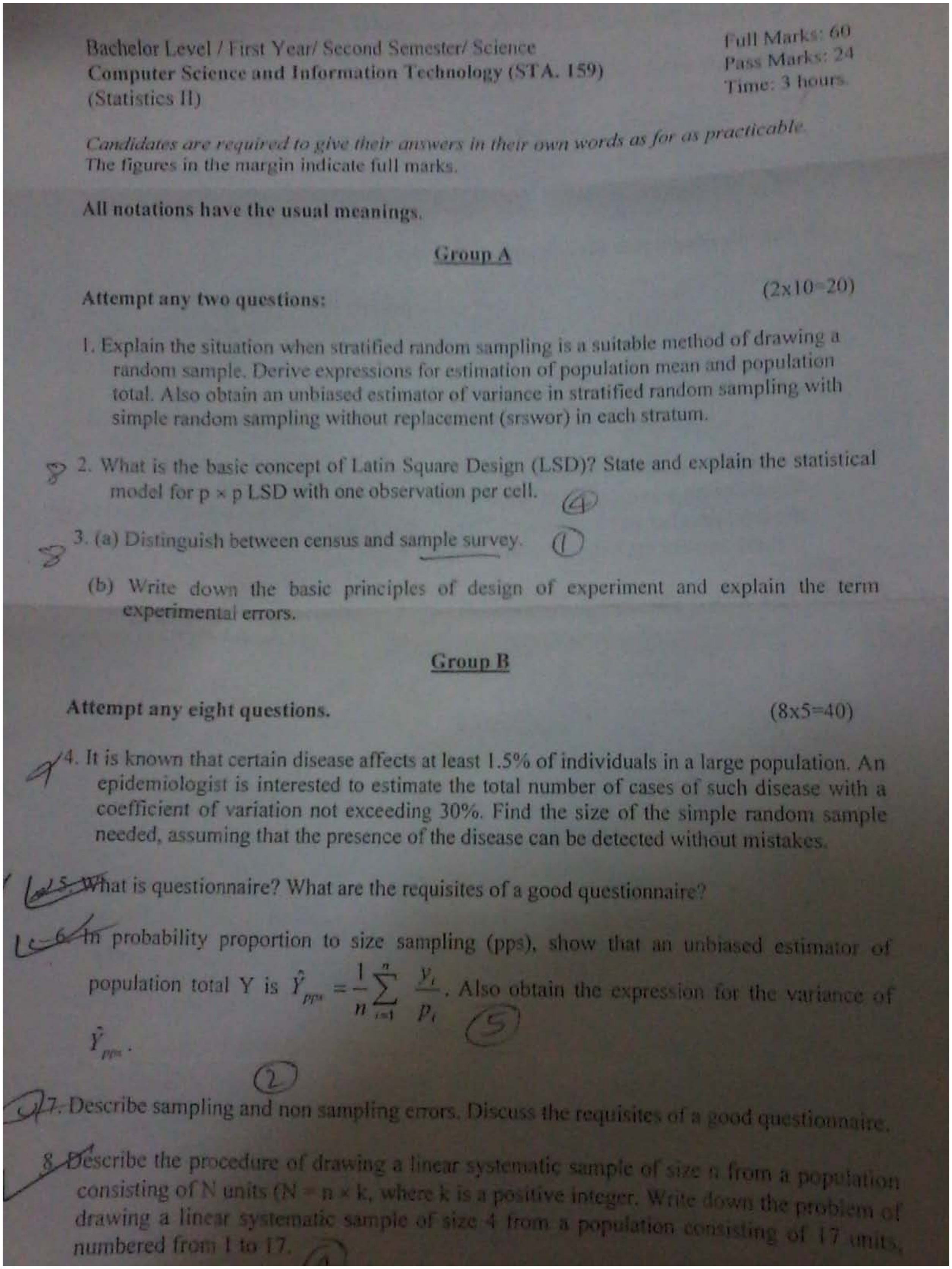


Bachelor Level / First Year/ Second Semester/ Science
Computer Science and Information Technology (STA. 159)
(Statistics II)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

All notations have the usual meanings.

Group A

Attempt any two questions: (2x10=20)

1. Explain the situation when stratified random sampling is a suitable method of drawing a random sample. Derive expressions for estimation of population mean and population total. Also obtain an unbiased estimator of variance in stratified random sampling with simple random sampling without replacement (srswor) in each stratum.

8 2. What is the basic concept of Latin Square Design (LSD)? State and explain the statistical model for p × p LSD with one observation per cell. ④

8 3. (a) Distinguish between census and sample survey. ①

(b) Write down the basic principles of design of experiment and explain the term experimental errors.

Group B

Attempt any eight questions. (8x5=40)

9 4. It is known that certain disease affects at least 1.5% of individuals in a large population. An epidemiologist is interested to estimate the total number of cases of such disease with a coefficient of variation not exceeding 30%. Find the size of the simple random sample needed, assuming that the presence of the disease can be detected without mistakes.

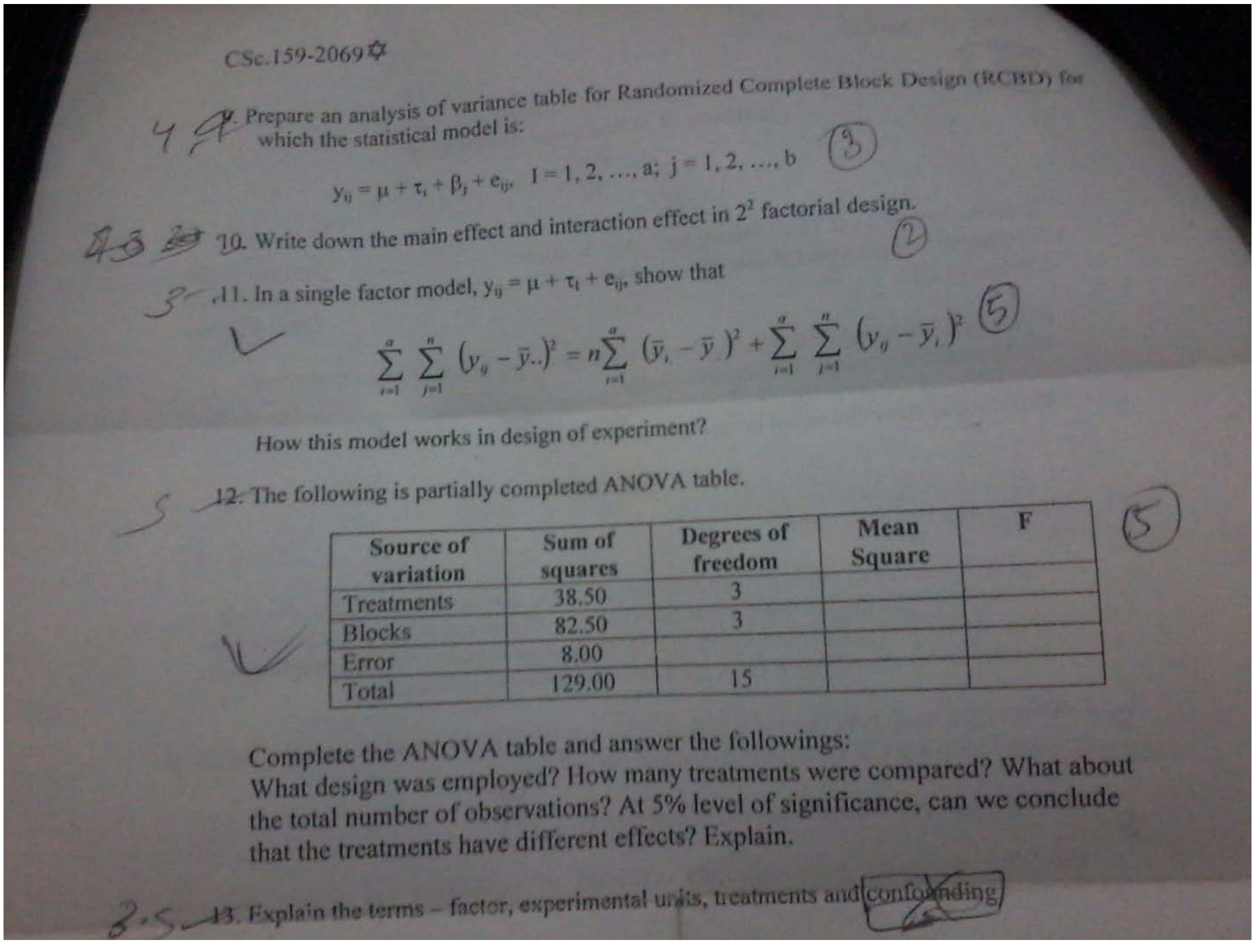
5. What is questionnaire? What are the requisites of a good questionnaire?

6. In probability proportion to size sampling (pps), show that an unbiased estimator of population total Y is $\hat{Y}_{pps} = \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{p_i}$. Also obtain the expression for the variance of $\hat{Y}_{pps}$. ⑤

②

9 7. Describe sampling and non sampling errors. Discuss the requisites of a good questionnaire.

8. Describe the procedure of drawing a linear systematic sample of size n from a population consisting of N units (N = n × k, where k is a positive integer. Write down the problem of drawing a linear systematic sample of size 4 from a population consisting of 17 units, numbered from 1 to 17.



CSc.159-2069✡

4 ~~9~~. Prepare an analysis of variance table for Randomized Complete Block Design (RCBD) for which the statistical model is: ③

$$y_{ij} = \mu + \tau_i + \beta_j + e_{ij}, \quad I = 1, 2, \ldots, a; \; j = 1, 2, \ldots, b$$

43 ~~10~~. Write down the main effect and interaction effect in 2^2 factorial design. ②

3 ~~11~~. In a single factor model, $y_{ij} = \mu + \tau_i + e_{ij}$, show that ⑤

✓

$$\sum_{i=1}^{a} \sum_{j=1}^{n} (y_{ij} - \bar{y}_{..})^2 = n \sum_{i=1}^{a} (\bar{y}_{i.} - \bar{y})^2 + \sum_{i=1}^{a} \sum_{j=1}^{n} (y_{ij} - \bar{y}_{i.})^2$$

How this model works in design of experiment?

5 ~~12~~. The following is partially completed ANOVA table. ⑤

✓

Source of variation	Sum of squares	Degrees of freedom	Mean Square	F
Treatments	38.50	3		
Blocks	82.50	3		
Error	8.00			
Total	129.00	15		

Complete the ANOVA table and answer the followings:
What design was employed? How many treatments were compared? What about the total number of observations? At 5% level of significance, can we conclude that the treatments have different effects? Explain.

3.5 ~~13~~. Explain the terms – factor, experimental units, treatments and ~~confounding~~